ICP-MS: Convert the Result Back to Powder

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Abstract. Convert ICP-MS solution results to a powder basis using the recorded sample mass, digestion volume and dilution. This note includes worked conversions and checks for blanks, recovery and quantification limits. Solution and powder LOQs must not be used interchangeably.

Keywords: ICP-MS; LOQ; digestion; dilution; elemental analysis

1. Calculate the reporting basis

For a blank-corrected solution concentration C, digest volume V, additional dilution factor D and sample mass m, the powder concentration is CV D/m. With C in µg/L, V in L and m in g, the result is µg/g, numerically equal to mg/kg.

Worked example: digest 0.200 g to 0.050 L and apply a fivefold dilution before measurement. A measured concentration of 2.0 µg/L corresponds to 2.0 × 0.050 × 5 / 0.200 = 2.5 µg/g. Confirm that the laboratory has not already included D in its reported concentration.

The same calculation converts a solution LOQ of 0.10 µg/L into a powder LOQ of 0.125 µg/g. A “less than” result must retain this limit rather than being entered as zero. Method 6020B describes matrix-dependent analysis and quality controls [1]; it does not provide implant-material acceptance limits.

2. Distinguish a clean number from a valid result

2.1 Confirm the digestion objective. Determine whether the preparation achieves the intended total digestion or only an extraction. Undissolved residue can invalidate a total-content claim. Use a suitable digestion assessment or reference material rather than assuming a clear-looking liquid proves complete recovery.

2.2 Read quality controls with the sample. Review preparation blanks, calibration checks, internal-standard behavior and suitable spike or reference-material results. A post-digestion spike assesses a different part of the method from a control that passes through digestion. Treat unexplained interference or poor recovery before interpreting a low sample result.

2.3 Apply the correct specification. Compare the final powder result and its LOQ with an established material requirement on the same dry or as-received basis. If the LOQ is above the required threshold, “not quantified” cannot establish compliance. Seek an appropriate analytical range rather than substituting zero.

3. Development decision

Keep the calculation traceable from the weighed powder to the final result. Confirm method suitability and the requirement basis before using a low elemental number in a product claim.

Table 1. Development comparison and interpretation controls.

Record	Example value	Role in the result
Powder mass	0.200 g	Defines material amount
Final digest volume	0.050 L	Converts concentration to mass
Additional dilution	5-fold	Restores diluted concentration
Solution LOQ	0.10 µg/L	Becomes 0.125 µg/g powder

Scope. All numerical values are illustrative. The EPA method is analytical context, not a medical-device impurity specification or an exposure limit.

References

1. US Environmental Protection Agency. Method 6020B: inductively coupled plasma-mass spectrometry. Revision 2. Washington (DC): US EPA; 2014 Jul. Available from: https://www.epa.gov/sites/production/files/2015-12/documents/6020b.pdf

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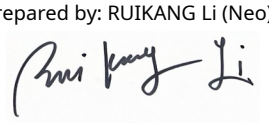

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